Change Detection Based on Artificial Intelligence: State-of-the-Art and Challenges

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Abstract

Change detection based on remote sensing (RS) data is an important method of detecting changes on the Earth's surface and has a wide range of applications in urban planning, environmental monitoring, agriculture investigation, disaster assessment, and map revision. In recent years, integrated artificial intelligence (AI) technology has become a research focus in developing new change detection methods. Although some researchers claim that AI-based change detection approaches outperform traditional change detection approaches, it is not immediately obvious how and to what extent AI can improve the performance of change detection. This review focuses on the state-of-the-art methods, applications, and challenges of AI for change detection. Specifically, the implementation process of AI-based change detection is first introduced. Then, the data from different sensors used for change detection, including optical RS data, synthetic aperture radar (SAR) data, street view images, and combined heterogeneous data, are presented, and the available open datasets are also listed. The general frameworks of AI-based change detection methods are reviewed and analyzed systematically, and the unsupervised schemes used in AI-based change detection are further analyzed. Subsequently, the commonly used networks in AI for change detection are described. From a practical point of view, the application domains of AI-based change detection methods are classified based on their applicability. Finally, the major challenges and prospects of AI for change detection are discussed and delineated, including (a) heterogeneous big data processing, (b) unsupervised AI, and (c) the reliability of AI. This review will be beneficial for researchers in understanding this field.